Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
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SOME ADDITIONAL FOSSIL ECHINI FROM JAMAICA

BY
BENJAMIN WALWORTH ARNOLD AND HUBERT LYMAN CLARK

WITH FIVE PLATES

CAMBRIDGE, U. S. A.
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After the publication of our Memoir on Jamaican Fossil Echini (1927, Mem. M. C. Z., 50, no. 1) the senior author spent some time in Jamaica and secured a large amount of additional material. Much of this very naturally duplicates the species already recorded but there are 13 specimens which represent apparently new species and a few others which call for special comment. It has therefore seemed advisable to prepare this report giving descriptions and figures of the new forms and such additional information as will help to a better understanding of the fossil echini of Jamaica.[1]

The new species here described represent nine genera of which one is new to science and four others were not previously listed from Jamaica. It is a regrettable fact that three of the new species must be referred to the heterogeneous group called Macropneustes. It is exceedingly difficult in the absence of spines, fascioles and pedicellariae to draw generic lines among spatangoids satisfactorily. It is therefore unavoidable, however regrettable it may be, that certain genera become large and unwieldly assemblages of forms which are not perhaps really closely related.

In the following pages the same systematic sequence is used as in our Memoir. Notes on previously described genera and species are thus intercalated in their natural position among the new forms. We prefer, however, to mention here a specimen of Ananchytes, which was found among stones and other curios, supposed to be of local origin, in a box at Richmond Hill. It is an internal mould (*i.e.* the cast of the interior of the test) and measures 37 mm. long, 30 mm. wide and 22 mm. high. It was obviously dug out of chalk and has the dark gray flinty appearance of similar specimens from England. So far as we can see this fossil is the English *Ananchytes ovatus*. The genus is not known from the West Indies, and it seems almost certain that this specimen must have been brought from England to Jamaica, probably in a box of curios.

[1] The death of the senior author, November 8, 1932, prevented the completion of the paper as originally planned and has seriously delayed its publication. But this is now made possible through the generous coöperation of Mrs. Arnold. Mr. Arnold was an unusual field worker and collector and his enthusiasm was contagious. He secured the assistance of natives in Jamaica to a remarkable extent and was thus able to get together an extraordinary collection of Jamaican fossil echini. Nearly all of this, including all the holotypes and most of the paratypes of our new forms, is now in the Museum of Comparative Zoology, the generous gift of the Arnold estate. In the death of Mr. Arnold this museum loses a generous friend, and science the services of an unpretending and enthusiastic collector. *H. L. C.*

ECHINIDAE

Scoliechinus axiologus

Arnold and Clark, 1927. Mem. M. C. Z., **50**, p. 23.

A badly weathered specimen of this species, previously known only from the holotype, measures 27 mm. in diameter. The characteristic arrangement of the pore-pairs is evident, but the tubercles are all badly worn down. The large peristome with conspicuous gill-cuts is a noticeable feature. There is nothing to show from what part of Jamaica this specimen came.

ECHINOMETRIDAE

Echinometra lucunter

Echinus lucunter Linné, 1758. Syst. Nat., ed. **10**, p. 665.
Echinometra lucunter Lovén, 1887. Bih. Svensk. Vet.-Akad. Handl., **13** (4), no. 5, p. 157.

A perfectly fossilized Echinometra, with the oral surface still imbedded in a fragment of open, porous limestone, seems to be unquestionably identical with the recent species so common on the coast of Jamaica today. It measures 38 mm. long, 34 mm. wide and about 20 mm. high. There are as a rule 6 pore-pairs in each arc, a few have but 5, and only one with 7 is visible. This interesting specimen was found in St. Elizabeth Parish.

CLYPEASTRIDAE

Clypeaster antillarum

Cotteau, 1875. Kongl. Sven. Vet. Akad. Handl., **13**, no. 6, p. 15.

We refer, with considerable hesitation, to this species, a Clypeaster with a flat oral surface, a well-arched dorsal side and large petals, which resembles the figure given by Jackson (1922, Carnegie Inst. Washington, publ. no. 306, pl. 5, figs. 1 and 2), but differs in having the test narrower, especially posteriorly. The upper surface is badly weathered so that the details of the petals are obscured. The specimen is 100 mm. long, 78 mm. wide and 26 mm. high, and is light slate gray in color. The exact locality is not known.

Clypeaster eurychorus [1] sp. nov.

Plate 1, figs. 1 and 2

Test 132 mm. long, 114 mm. wide and 51 mm. high at apex; these measurements are approximate only, owing to the defective condition of the specimen. The highly arched test slopes more rapidly and uniformly anteriorly than posteriorly; apex a little posterior to center; text thicker through interambulacrum 5 than in ambulacrum 3; posterior to the apex the test is nearly flat for 20 mm. and then slopes quite abruptly to margin; apical system about 10 mm. in diameter markedly elevated, its center about 4 mm. above the proximal part of the petals. Petaloid area very large covering about two-thirds of the dorsal surface; petals I and V, obovate, 56 mm. long by 35 mm. wide, almost closed distally, with poriferous areas nearly 10 mm. wide where widest and interporiferous area nearly 16 mm. across; petals II and IV shorter and more broadly obovate, 43 x 32 mm., open 3 or 4 mm. at tip, with poriferous areas about 8.5 mm. across and interporiferous, 15 mm.; petal III, relatively longer and narrower than the others, about 56 x 32 mm.; the extreme tip is wanting but apparently the petal was nearly or quite closed; poriferous areas 8 or 9 mm. across with the interporiferous barely 15 mm. In all the petals the pore-pairs are crowded, 10–12 to a centimeter, the ridges between the pairs carry a single series of about 10 tubercles. Whole tuberculation of aboral surface rather close and fine. Genital pores 5, fairly distinct, about 5 or 6 mm. from center of abactinal system.

Oral surface more or less concealed in matrix; so far as visible, it is quite flat with no indication of concavity or even of a depression about the mouth, which is wholly concealed. Periproct not certainly determinable; apparently, it is about 4 mm. in diameter and its center is 9 mm. from posterior end of test.

Holotype (M. C. Z. 3,474) and only specimen, from Jamaica but no more definite locality is known.

This species is quite unlike any other of the West Indian forms, the height combined with the large, closed petals and the flat oral surface being sufficiently distinctive. Whether the elevation and position of the abactinal system and the abrupt slope of the posterior end of the test are constant features remains to be shown but if they are, the species is unmistakable. It seems to belong in the same group with *duchassaingi* Michelin and *ambigenus* (Lamarck).

[1] εὐρύχωρος = spacious, in reference to the big petals.

FIBULARIIDAE

Sismondia crustula

Hawkins, 1927. Mem. M. C. Z., 50, p. 78.

We are glad to report that a single specimen of this species was secured in 1928, but the exact locality was not recorded.

SCUTELLIDAE

Encope homala [1] sp. nov.

Plate 2, fig. 1

Test 115 mm. long, 100 mm. wide, and only 9 mm. thick; greatest thickness in ambulacrum III; at margin thickness is only 5 mm., and whole posterior half of test is uniformly about 5 mm. thick. Test somewhat crushed and no doubt flattened artificially but it is evident that it was never arched and only a very little elevated at abactinal system. This system has been damaged by crushing but its chief features are still evident; madreporite conspicuously star-shaped, the axis of each ray about 6 mm. long, with numerous fine pores; genital pores set well down in each interambulacrum 2 mm. or more from the tip of the ray of the madreporite; in interambulacrum 1 there are at least 2 pores, probably 3 and possibly 4; in 2, there are 2 pores, the larger one right at the tip of the madreporic ray; in 3, and in 4, a single pore as usual is present; in 5, there are probably 2 pores but possibly only 1.

Petaloid area about 40% of dorsal surface; petals I and V, 40 mm. long and 12 mm. wide, open distally about 1½ mm.; petals II and IV, 32 mm. long, 12 mm. wide, apparently nearly closed at tip; petal III, 36 mm. long, 13 mm. wide, well open at tip, apparently for about 3 mm. Marginal notches probably present in all ambulacra; in I and V, 5 or 6 mm. deep and about 4 mm. wide; in II and IV, 6 or 7 mm. deep and 5 or 6 mm. wide; in III, 10 mm. deep, about 5 mm. wide and nearly or more probably quite closed in at margin, forming a lunule. Interambulacral lunule in area 5, about 20 mm. long, nearly 5 mm. wide, its posterior end about 13 mm. from margin of test.

Oral surface wholly concealed by matrix. Color of specimen light gray-brown, with interporiferous areas lighter and poriferous areas darker.

Holotype (M. C. Z. 3,475) and only specimen, from the parish of Manchester.

[1] ὁμαλός = flat, level, in reference to the unusually flat test.

This Encope is very different from any of the recent species of the genus, nor do we find any of the fossil forms, of which a number have recently been described, any nearer. Aside from the very flat test, the position of the genital pores and the form of the lunules are very distinctive characters.

NUCLEOLITIDAE

Haimea vs. Pauropygus

Shortly after the publication of our Memoir, Professor Hawkins kindly called our attention to the fact that Lambert (1925, Comp. Rev. Soc. Geol. France, p. 232) had recorded *Haimea caillaudi* Michelin from Spring Mount, Jamaica, and it seemed to be probable that our genus Pauropygus was a pure synonym of Haimea. Through the great kindness of Señor Mario Sanchez Roig of Havana we have received one of the Spring Mount specimens identified by Lambert as Haimea. There is no doubt that it is a fairly typical example of our *Pauropygus elevatus*. Careful comparison of Michelin's description and figure with Jamaican specimens of Pauropygus have satisfied us that Lambert is right, Pauropygus is a synonym of Haimea and *P. elevatus* is *H. caillaudi*. As a consequence of this interesting discovery, certain changes in the nomenclature of a number of West Indian fossil echini become necessary and for convenience of other workers we list them herewith:

Pauropygus Arnold & Clark, 1927 = Haimea Michelin, 1851, Rev. et Mag. Zoöl., no. 2, pp. 2 and 3. Type-species, *Haimea caillaudi* Michelin, *l.c.* p. 2, pl. 2, fig. 2.
Pauropygus altus Arnold & Clark becomes *Haimea alta* (A. & C.)
Oligopygus alvarezi Lambert & Sanchez Roig becomes *Haimea alvarezi* (L. & S. R.)
Pauropygus convexus Arnold & Clark becomes *Haimea convexa* (A. & C.)
Pauropygus cylindricus Arnold & Clark becomes *Haimea cylindrica* (A. & C.)
Pauropygus elevatus Arnold & Clark is a synonym of *Haimea caillaudi* Mich.
Pauropygus latus Arnold & Clark becomes *Haimea lata* (A. & C.)
Pauropygus ovumserpentis Arnold & Clark, i.e. *Echinolampas ovumserpentis* Guppy, 1866, becomes *Haimea ovumserpentis* (Guppy).
Pauropygus parvipetalus Arnold & Clark, becomes *Haimea parvipetala* (A. & C.)
Pauropygus platypetalus Arnold & Clark becomes *Haimea platypetala* (A. &. C.)
Pauropygus pyramidoides Arnold & Clark becomes *Haimea pyramidoides* (A. & C.)
Pauropygus rotundus Arnold & Clark becomes *Haimea rotunda* (A. & C.)
Pauropygus rugosus Arnold & Clark becomes *Haimea rugosa* (A. & C.)
Pauropygus stenopetalus Arnold & Clark becomes *Haimea stenopetala* (A. & C.)

All of the specimens of Haimea collected in Jamaica in 1928 fall very easily into one or the other of the species already described. There are no new forms and no individual whose identification has caused any difficulty. There are a number of additional specimens of several of the rarer species but unfortunately there is no additional material of *platypetala*.

CASSIDULIDAE

Cassidulus platypetalus[1] sp. nov.

Plate 1, figs. 3–5

Test 34 mm. long, 28 mm. wide and 18 mm. high; width is thus about .80 of length and height is .53. Surface so much weathered that tubercles are visible only in a part of interambulacrum 3; they are small, well-spaced and not peculiar. Test broadly oval, little wider across petals I and V than it is anterior to the apex. Apical system distinctly excentric anteriorly, only 15 mm. from anterior end of test; no genital pores or other features of the apical system can be made out; test is nearly flat apically and slopes abruptly, almost vertically to the ambitus at anterior end, but posteriorly it slopes very gradually to the periproct and then more abruptly to ambitus. Periproct conspicuous from above, 5 mm. long and 4 mm. wide, with its posterior or lower margin 3 mm. from rear end of test.

Petaloid area very large occupying about 80% of the aboral surface. Poriferous areas approximately equal in all petals. Petals I and V, about 15 mm. long and scarcely 7 mm. wide, not quite closed at tip, with poriferous areas, each 1.5 mm. wide near middle; petals II and IV, more broadly oval, 14 mm. long, fully 7 mm. wide; with a somewhat attenuate tip open by about a millimeter; petal III, longer and narrower than the others, about 16 mm. long and little more than 6 mm. wide, the tip open by fully 1.5 mm.

Oral surface, concave along the axis III–5, especially near the mouth; peristome small, obscured by matrix, about 15 mm. from anterior end of test; phyllodes conspicuous 5 to 6 mm. long by 3 mm. wide; bourrelets, if present, concealed by matrix. Color pale brown or dirty whitish.

The holotype (M. C. Z. 3,476) was the only specimen secured and there is no record of the locality.

Cassidulus sphaeroides[2] sp. nov.

Plate 1, figs. 6–8

Test 38 mm. long, 36 mm. wide, and 25 mm. high; width is thus about .95 of length and height is .65. Surface so much weathered there is no indication of

[1] πλατὺς = broad + πέταλον = a petal, in reference to the notably wide petals.

[2] *sphaeroides* = like a sphere, in reference to the high test and nearly circular ambitus.

tubercles or ornamentation except orally in interambulacrum 5 where a few tubercles are visible, and beside the matrix which covers most of the oral surface there are tubercles and some pits to be seen. Test almost circular in outline, the greatest width, however, being back of the apical system, which is totally lacking; apex nearly central and from it the test slopes almost uniformly in all directions; interambulacrum 5 abruptly truncate, the flattened area, however, is not quite vertical but slopes a little from its upper margin downward and outward to ambitus. Periproct very large and area around it depressed, conspicuous from above; owing to weathering, exact measurements cannot be given but apparently the periproct itself was at least 8 mm. high and 6 mm. wide; lower margin only 2 mm. or less from rear end of test.

Petaloid area large, occupying about 72% of the aboral surface. Petals I and V, about 18 mm. long and 6 mm. wide, the interporiferous area being only a trifle over 2 mm. across; the tips of the petals are damaged so that it is impossible to say whether they were closed or open; petals II and IV larger and wider, about 20 mm. long by 7 mm. wide, with the posterior poriferous area distinctly longer than the anterior; interporiferous area 4 mm. wide; petals open at tip by about 1.5 mm.; petal III, 19 mm. long, a trifle over 5 mm. wide, slightly open at tip as poriferous areas converge but little; in petals I, V and III, the poriferous areas show no evident inequality but the condition of the tips does not permit of certainty in the matter.

Oral surface almost wholly concealed by a considerable mass of matrix, so that nothing can be determined as to position or appearance of peristome and its surroundings; apparently the lower surface of the test was nearly flat but there may have been considerable depression near mouth. Color dirty whitish.

The holotype (M. C. Z. 3,477) was the only specimen secured.

This species and the preceding represent a group of fossils not hitherto known from Jamaica, easily recognized by the position of the periproct on the dorsal surface. It seems to us they are better referred to Cassidulus than to any of the genera that have been split off from that somewhat heterogeneous group. But it may be that with more and better preserved material, it will be possible to place them more accurately. The two specimens are so unlike each other in form of test and in the petals that they cannot be referred to the same species, nor do we find any previously described cassiduloid to which either one may be referred. They make a very interesting addition to the Jamaican fauna.

Rhynchopygus punctatus

Plate 1, figs. 9–11

Arnold and Clark, 1927. Mem. M. C. Z., 50, p. 55.

One of the notable specimens secured in 1928 was a fine adult of this rare species. The specimen (M. C. Z. 3,478) is 41 mm. long, 31 mm. wide and 12 mm. high, almost double the size of the holotype. The oral surface is typical of the species, depressed so as to be concave in the long axis, conspicuously "punctate with numerous, deep, more or less circular pits, .10–.25 mm. in diameter, without definite arrangement." The periproct is 6 mm. wide and 4 mm. high and there is no overhang of interambulacrum 5 above it, yet the area is distinctly depressed.

It is unfortunate that there is no label to indicate where this specimen was secured.

HEMIASTERIDAE

Homœopetalus [1] gen. nov.

Test ovate, depressed, with small petaloid area; apical system excentric posteriorly; all petals slightly sunken, III the least so; interporiferous areas very narrow, practically wanting; petal III longer than the others, with pores notably smaller and less circular; periproct submarginal but size and position unknown; peristome and other characters of oral surface unknown; number of genital pores unknown.

Type-species: — *Homœopetalus axiologus* sp. nov.

This is a peculiar genus unlike any Recent or fossil spatangoid, but owing to the poor condition of the unique specimen, we cannot be sure even of its family position. There is no indication of fascioles, nor of a subanal plastron, and we are, therefore, placing it in the Hemiasteridae. While the flattened condition of the test may be due in some slight degree to pressure, it is evident from the appearance of the plates at the ambitus that no marked change of form has been produced artificially.

[1] ὅμοιος = similar, in reference to the fact that the five petals are so much alike.

Homœopetalus axiologus[1] sp. nov.

Plate 2, figs. 2 and 3

Test 63 mm. long, 54 mm. wide and 27 mm. high; the vertical measurement is approximate only, owing to the condition of the oral surface, but the height is certainly much less than half the length and probably half the width is about the normal condition; the width is nearly .90 of length. Test widest just in front of petals II and IV, somewhat narrower back of abactinal system, its general outline being rounded ovate. Apical system conspicuously excentric posteriorly, being placed only about 25 mm. from posterior end of test. Genital pores and all other details of the apical system quite indeterminable.

Petaloid area small, only about half the aboral surface; petals all notable for their definite form, with closed, rounded ends and practical lack of any interporiferous area; all are somewhat depressed, I and V, the most so, III the least; in petal III, the pores are relatively small, obliquely elongated and inconspicuous while in the other petals they are large and round, but the circular form is undoubtedly exaggerated by weathering, as no doubt the size is also; petals I and V are 18 mm. long by 5 mm. wide; II and IV are 20 x 5 mm.; and III is 25 x 5 mm. Interambulacrum 5 forms a low, rounded ridge between petals I and V; interambulacra 2 and 4, but especially 2, are compressed into ridges while 1 and 3 are quite flat; it is impossible to determine positively what conditions were in life, but we are inclined to believe that all the interambulacra except 5 were relatively flat between the petals. Tuberculation of test has largely disappeared but in interambulacrum 3 enough is present to show that it was more or less irregular in size and distribution; some of the tubercles are notably larger than the great majority but they show no definite arrangement.

In interambulacrum 5, below the ambitus, there is an oval area, about 7 mm. long by 5 mm. wide which may possibly indicate the position of the periproct but this is doubtful; the area in question has its posterior margin about 7 mm. from the rear end of the test; no other features of the oral surface can be made out because of the condition of the specimen. Color light brown and dirty whitish.

The unique holotype (M. C. Z. 3,479) was secured at an unrecorded locality, a label never having been written. It has puzzled us, it is so unlike any other

[1] ἀξιόλογος = remarkable, of obvious significance.

spatangoid we have seen. The general appearance reminds one strikingly of a clypeastroid but the petals are very definitely those of a hemiasteroid. It will not be confused with any other West Indian fossil.

Linthia obesa[1] sp. nov.

Plate 2, figs. 4–6.

Test 74 mm. long, 71 mm. wide and 52 mm. high; width is thus more than .95 of length and height is .70. Test notably high, with apical system approximately at center, falling away rapidly to ambitus on all sides. Interambulacra 5, 2 and 3 forming low rounded ridges adapically, particularly 5, while 1 and 4 are conspicuously wider and flatter. Petals I and V, about 25 mm. long by 5 mm. wide, diverging so little that their distal tips are only about 20 mm. apart; petals II and IV longer and wider, probably about 30–35 mm. long by 7 mm. wide, but their distal parts are so damaged or concealed by matrix accurate measurements cannot be made; they run forward, more than outward, and their tips were about 45 mm. from each other; petal III is about 40 mm. long by 7 mm. wide but is more or less filled with matrix which conceals its distal end. All the petals are deeply sunken. Genital pores and other details of the abactinal system cannot be made out.

Ambitus broadly rounded, ill defined posteriorly where the test is truncate with the flattened area sloping somewhat adorally; there is apparently some depression of the test at the ambitus in ambulacrum III. Periproct not detectable but doubtless on the truncate, oblique surface of the rear of the test. Oral surface of test not at all flattened but notably swollen and rounded, especially the posterior part of the sternum. Peristome concealed by matrix but evidently little depressed, very far forward, its anterior margin not over 12–15 mm. from anterior end of test. No indication of tubercles remains except at anterior end of test; there a number of rather crowded small tubercles are visible above the ambitus while orally much larger and rather widely spaced tubercles may be seen. Color of specimen light gray.

Holotype, M. C. Z. 3,482.

There may be room for difference of opinion as to whether this species is a true Linthia or not but it seems nearer to *L. trechmanni* than it is to any other West Indian spatangoid, and there seems no objection to referring it to the same

[1] *obesus* = fat, stout, in reference to the striking form of the test.

genus. The form of the test is so distinctive in *obesa* that it will not be confused with any other species, and we see no indication that this form is the result of pressure or any other external conditions.

Cyclaster stereа[1] sp. nov.

Plate 3, figs. 4 and 5

Test distorted by pressure along the antero-posterior axis but the distortion seems to be chiefly if not wholly in front of the apex and on the right hand side; in other words the right anterior quarter of the test is crowded back against the vertical axis so as to make the anterior end of the fossil an almost vertical surface about 50 mm. high; at present the length of the test is only about 85 mm. but we estimate that in life it was from 95 to 100 mm.; the width is 86 mm. across the apex, where it is widest, and in life was about the same; height 72 mm. but in life was probably quite a little less, as there is good reason to think that the pressure which so evidently shortened the long axis has increased the vertical. Nothing can be made out as to genital pores or details of abactinal system; periproct and most of oral surface concealed by matrix; peristome wanting, and tuberculation of test so worn and deficient as to be insignificant.

Petaloid area large, occupying most of the highly arched upper surface. Apex probably anterior to center of test, at least to some extent. Petals I and V nearly 55 mm. long, about 6 mm. wide, deeply sunken and largely filled with matrix; interporiferous area insignificant; tips closed; distance of tips from each other, across interambulacrum 5, about 37 mm. Petals II and IV extend out opposite to each other, almost at right angles to long axis of test, curving forward just a little distally; they are filled with matrix but measure about 50 mm. long by 6 mm. wide. Ambulacrum III is not at all petaloid and is only slightly depressed but probably at the ambitus it made a broad and shallow concavity. Oral surface not at all flattened but surprisingly convex; owing to the condition of the specimen, however, it is impossible to say how much of the convexity is natural. Color pale gray.

Holotype, M. C. Z. 3,483.

In view of the condition of this unique specimen it is by no means easy to assign it to a genus, but as it is so markedly different from any other Jamaican fossil, we feel it is important to give it a name. It seems to fall into the genus

[1] στερεά = massive; of obvious significance.

Cyclaster somewhat better than into any of the related groups but it is quite different from the two species of Cyclaster which Sanchez Roig describes (1926) from Cuba, and will not be confused with any other West Indian echinoid.

Victoriaster jamaicensis[1] sp. nov.

Plate 3, figs. 1–3

Test so badly damaged that the following measurements are only approximations or estimates, but they will give a fair idea of the extraordinary character of this fine species. The specimen is an internal mould, *i.e.* a cast of the interior of the original test, which is now entirely lacking. Length, through III–5, about 93 mm. but measured from the anterior margin of test on either side of III, it is nearly 105 mm.; width evidently much more than this perhaps as much as 125 mm.; height at apex 40 mm. Apical system excentric posteriorly, about 62 mm. from anterior margin of test, concealed by a bit of matrix. Test slopes rather abruptly and almost uniformly on all sides to a moderately thick margin.

Petals I and V, 28 mm. long by 6 mm. wide, deeply depressed, with practically no interporiferous area, diverging very considerably from each other so that their tips are about 30 mm. apart. Petals II and IV, nearly 50 mm. long by 7 mm. wide, markedly depressed near middle but almost flush with test at both distal and proximal ends; distal third widest portion of petal, its sides almost parallel. Petal III, very wide and very deeply sunken distally, about 60 mm. long and 15 mm. wide, marginal notch at ambitus about 12 mm. deep. Oral surface quite flat, but peristome, and the ambulacra as they approach it, with adjoining parts of interambulacra 1 and 4, considerably sunken, the labrum projecting correspondingly. Peristome about 18 mm. wide and 7 mm. long, its anterior margin about 12 mm. from the ambitus in the depression of ambulacrum III. Sternum well marked, about 50 mm. long by 30 mm. wide. Color dirty yellowish-brown.

Holotype, M. C. Z. 3,484.

This very remarkable spatangoid seems to us to be undoubtedly congeneric with *Victoriaster lamberti* Sanchez Roig from Cuba. Details of the petals and of the oral surface make it clear that the Jamaican form is a different species, but that it is nearly related to its Cuban congener admits of little doubt. It is strikingly unlike any other Jamaican species. Only the damaged holotype was secured.

[1] *jamaicensis* = of Jamaica, of obvious significance.

SPATANGIDAE

Antillaster arnoldi

H. L. Clark, 1927, in Arnold and Clark, Mem. M. C. Z., **50**, p. 62.

It is very interesting to find another specimen of this huge species even if it is not nearly so well preserved as the holotype. It was secured at Spring Mount close by the spot where the original specimen was discovered.

Macropneustes dyscritus [1] sp. nov.

Plate **4**, figs. 1 and 2

Test 100 mm. long, 90 mm. wide and 43 mm. high, more or less distorted by pressure which has undoubtedly shortened the long axis, increased the width and decreased the height; pressure has also closed more or less the proximal portions of the paired petals. Apex markedly anterior, only about 25 mm. back of the front margin of the test; even in life its anterior position must have been conspicuous. Details of the apical system, periproct and peristome are concealed by distortion, weathering or matrix. Unpaired petal and details of ambulacrum III are also lacking. Oral surface flat, the posterior part of sternum somewhat elevated and convex, all visible portions covered with a very uniform and close tuberculation.

Petals I and V about 55 mm. long, probably about 7 mm. wide but deeply sunken, and now almost or quite closed by pressure, except near tips which are hardly 35 mm. apart; details obscured by matrix. Petals II and IV about 48 mm. long, apparently reaching to ambitus, fully 7 mm. wide but deeply sunken and now more or less completely closed by pressure except distally; they run out at right angles to the long axis of the test. Color light gray.

Holotype, M. C. Z. 3,485.

In the appearance of the petals this unique specimen reminds us of *M. angustus* but the difference in the shape of the test is so great, we cannot believe it should be referred to that species. With all due allowance for the effects of pressure in both species, we think that in life they must have been quite unlike. Nor is there any other West Indian sea-urchin to which the present specimen is nearly allied and we, therefore, reluctantly name it and place it in the already heterogeneous genus Macropneustes.

[1] δυσκρίτος = hard to determine, of obvious application.

Macropneustes sinuosus [1] sp. nov.

Plate 4, figure 3

Test about 87 mm. long, more than 100 mm. wide and about 40 mm. high, but as the specimen is badly distorted by pressure, these figures have little value. We estimate that in life the individual was about 95 mm. long and nearly as wide, while the height was less than half as much. Entire posterior end and whole oral surface completely lacking, occupied by matrix. Ambulacrum III, wide, not at all petaloid and very slightly depressed even at ambitus; petals I and V fully 55 mm. long, by 6 mm. wide, with no interporiferous area, the poriferous areas almost parallel; the two petals are about 55 mm. apart at their tips. Petals II and IV run out at right angles to the long axis of the test; they are similar to the posterior petals in width and general appearance but their length is in doubt owing to the damaged condition of the specimen; apparently they were about 45 mm. long. All paired petals distinctly but not markedly depressed. Interambulacral plates of dorsal side few and large; those near ambitus are 20–30 mm. wide and 10–12 mm. high. Median sutural line in each interambulacral area, but particularly in 1, 4 and 5, very conspicuously sinuate. This feature would probably not be so conspicuous in well preserved specimens. Color light fawn or dirty white.

Holotype, M. C. Z. 3,486.

Here again we have a unique specimen that seems to be better referred to Macropneustes than to any other genus, which nevertheless cannot be assigned to any species hitherto described. It is undoubtedly seriously distorted, but nevertheless it was certainly low and wide with very long and only slightly depressed petals. We cannot see that it is very near any of the numerous species of Macropneustes we have handled.

Macropneustes stenopetalus [2] sp. nov.

Plate 4, figs. 4 and 5.

Test 74 mm. long and 68 mm. wide; its height is apparently a trifle less than half the length but owing to matrix on the lower surface no accurate measurement can be made. Test rather flat both above and below with thick well rounded mar-

[1] *sinuosus* = full of bendings, in reference to the conspicuously sinuous interradial sutures.

[2] στενός = narrow + πέταλον = petal, in reference to the narrow petals.

gin. Apical system excentric anteriorly less than 30 mm. from anterior margin of test. Tuberculation of test rather close but irregular with very small, small and rather large tubercles; the large tubercles are found in all the interambulacral areas but show no definite arrangement; they are rather more than a $^1/_2$ mm. across. Periproct just below posterior margin of test, about 7 mm. high by 6 mm. wide, but partly concealed by matrix.

Petals I and V only a little depressed, 35 mm. long by only 5 mm. wide, their tips about 35 mm. apart, with practically no interporiferous areas. Petals II and IV similar, but only about 30 mm. long, diverging widely from the long axis of test but curving slightly forward especially near tip. Ambulacrum III, not at all petaloid, and barely sunken, except at ambitus, where there is an evident though shallow depression. Peristome and whole lower surface concealed by matrix. Color light gray.

Holotype, M. C. Z. 3,487.

This specimen, both by its form and tuberculation reminds one at once of Spatangus but the petals are, of course, very different. There seems no doubt that we have here an undescribed species, and it apparently belongs with the other forms that we are referring to Macropneustes. At any rate it will not fit as well in any other genus.

Metalia dubia [1] sp. nov.

Plate 5, figs. 4–6

Test 68 mm. long, 63 mm. wide and only 28 mm. high, broadly ovate with the anterior end truncate and the posterior end deeply notched; in its present condition, the test is highest anterior to the apical system and posterior to that point is markedly and rather suddenly depressed, but it is probable that this depression is artificial and that the test sloped gradually backward to the posterior end, which is truncate and largely occupied by the very large, markedly depressed periproctal area, 15 mm. high and 14 mm. wide. Anterior end and sides of test badly weathered, leaving no details of structure. Oral surface covered by matrix.

Petals I and V about 36 mm. long and nearly 10 mm. wide; interporiferous area insignificant and tips of petals closed; they are but slightly depressed distally and the rather marked depression proximally would seem to be artificial; they are markedly curved, diverging much from each other near the apical sys-

[1] *dubia* = doubtful, in reference to our uncertainty regarding its true status.

tem, then running more nearly parallel for a time and then diverging again at tip. Petals II and IV are very badly weathered but were apparently about 32 mm. long by 9 mm. wide; they are scarcely at all depressed, run out at almost right angles to the long axis of the test, but curve forward a trifle at tip; at base they are very narrow, the posterior margin is nearly straight, while the anterior margin diverges anteriorly and is a trifle curved. Ambulacrum III was apparently not petaloid and was but slightly depressed even at ambitus. Color dull yellow.

Holotype, M. C. Z. 3,488.

In spite of its poor condition we think this specimen is entitled to a name and in view of its general form and the petals, it may well be put in Metalia. But it is certainly not the same species as the following (*M. jamaicensis*) for the shape of the test, the periproct, and the petals are all very different from the better preserved holotype of that species.

Metalia jamaicensis [1] sp. nov.

Plate 5, figs. 1–3

Test 81 mm. long, 71 mm. wide and 45 mm. high, broadly oval, truncate posteriorly, and evidently, but not deeply, notched in front, in ambulacrum III. Test highest anterior to apical system in interambulacra 2 and 3, sloping very abruptly to the front and very gradually to the posterior end. Details of apical system cannot be made out. Periproct about 11 mm. high by 8 mm. wide, but its outlines are indistinct as the whole rear end of the test is badly weathered; for this reason no details of the subanal plastron can be made out, though there are indications of its presence. Oral surface of test rather flat, but the sternum shows an evident, though rounded keel, the rear end of which is about 15 mm. from the end of the test itself. Peristome very little depressed, about 6 mm. long by 14 mm. wide, with the labrum only moderately projecting; anterior margin of peristome about 15 mm. from anterior end of test.

Petals I and V about 35 mm. long and 6 mm. wide, a little depressed; interporiferous area about as wide as one poriferous; petals narrower and closed at tip; the two petals are about 4 mm. apart at their proximal ends and only 30 mm. at the distal tips. Petals II and IV, more or less buried in matrix but apparently about 30 mm. long and 5 mm. wide, somewhat depressed; they run outward and

[1] *jamaicensis* = of Jamaica, because it is the first indubitable Metalia to be found in Jamaica.

a little forward but do not seem to be curved. Ambulacrum III not petaloid, almost flush with apical system but becoming quite deeply sunken distally, forming a conspicuous marginal notch at ambitus; extreme anterior end of test broken and badly weathered. Fascioles almost indistinguishable except around tip of petal II where the characteristic peripetalous fasciole of Metalia (and its allies) is very distinct for some 15 mm.; it is about 1.5 mm. wide. Tuberculation of test, so far as it still shows, rather close and uniform except in interambulacra 2 and 3 along the margins of ambulacrum III where conspicuously larger, but not big, tubercles are evident. Color pale gray or dirty whitish.

Holotype, M. C. Z. 3,489.

The resemblance of this notable fossil to *Metalia sternalis*, the Recent species of the Indo-Pacific region is so striking as to leave no doubt of their being congeneric. It is true that *sternalis* shows considerable diversity in shape of test, position of apex and confluence of petals I and V at their proximal ends but there are specimens in the Museum of Comparative Zoölogy which have the test of almost exactly the shape and proportions shown by this Jamaican fossil. As a rule, the apex is distinctly more anterior in *sternalis* than in *jamaicensis* and interambulacra 1 and 4 are noticeably higher near the apical system. The really important difference between the two species is, however, in the posterior petals; in *sternalis* these are more or less confluent proximally, while in *jamaicensis* they are well separated throughout their length. The occurrence of so typical a Metalia in the fossiliferous rocks of Jamaica is of the greatest interest and forms another link between the West Indian and Indo-Pacific faunas.

Eupatagus alatus

Arnold and Clark, 1927. Mem. M. C. Z., **50**, p. 63.

A notable specimen of this species is exceptionally high and shows only the posterior pair of genital pores; in other respects it is evidently to be referred to *alatus*. It is somewhat distorted by pressure which has pushed the right side forward a little and possibly diminished the width and increased the height a little; the apparent absence of genital pores in 2 and 3 may be due to a displacement of plates due to this same pressure, but this does not seem to us assured. The test measures, as it is, 41 mm. long, 33 mm. wide and 26 mm. high; in life the measurements were probably about 40 x 35 x 25 mm. As the normal height in *alatus* is only a little over half the length and is not rarely less than that, this individual is very conspicuous. Its color is almost white.

Eupatagus grandiflorus

Euspatangus grandiflorus Cotteau, 1875. Kongl. Sven. Vet. Akad. Handl., **13**, no. 6, p. 45.
Eupatagus grandiflorus Jackson, 1922. Carnegie Inst. Publ. 306, p. 89.

The discovery of this fine species in Jamaica is very interesting, as it was previously known only from a single specimen taken in the Eocene limestone of St. Bartholomew. The present specimen is a trifle larger than the holotype as it is about 80 mm. long by 60 mm. wide. It has been damaged and distorted by pressure, but its normal height was apparently about 35 mm. It is evidently, therefore, much flatter than Cotteau's specimen, and we do not believe that any important part of the difference in height is due to artificial depression in our specimen, but it seems to us that the holotype may possibly be compressed more or less. At any rate the petals are so characteristic we cannot doubt that this Jamaican specimen belongs to Cotteau's species.

EXPLANATION OF PLATES

All figures are natural size and represent the holotypes, excepting only *Rhynchopygus punctatus*. The side views are all of the left side.

PLATE 1

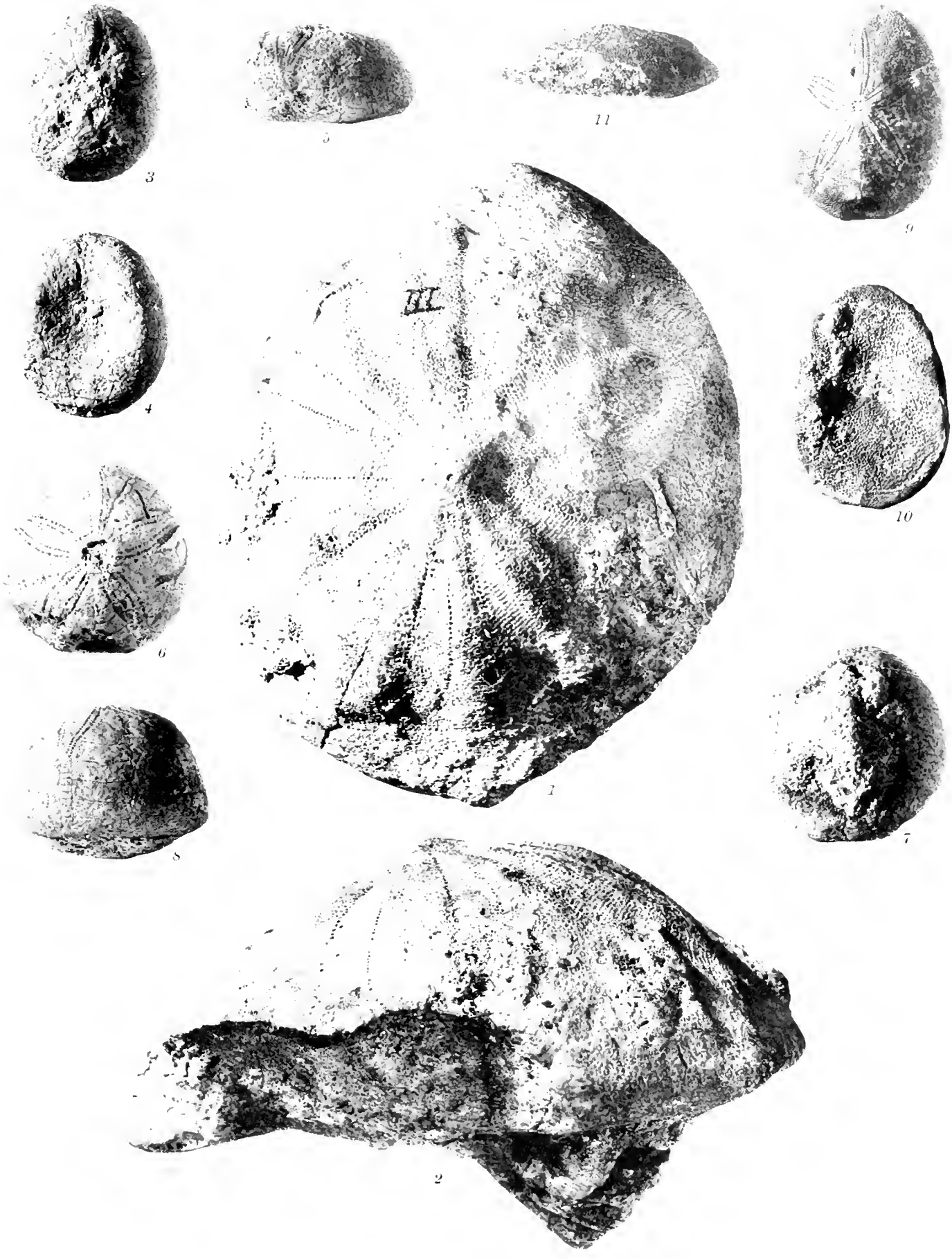
PLATE 1

Fig. 1, 2. *Clypeaster eurychorus* Arnold and Clark.
1. Aboral view.
2. Side view.

Fig. 3–5. *Cassidulus platypetalus* Arnold and Clark.
3. Aboral view.
4. Oral view.
5. Side view.

Fig. 6–8. *Cassidulus sphaeroides* Arnold and Clark.
6. Aboral view.
7. Oral view.
8. Side view.

Fig. 9–11. *Rhynchopygus punctatus* Arnold and Clark.
9. Aboral view.
10. Oral view.
11. Side view.



THE HELIOTYPE CORP. BOSTON

PLATE 2

PLATE 2

Fig. 1. *Encope homala* Arnold and Clark.
Aboral view.

Fig. 2, 3. *Homaeopetalus axiologus* Arnold and Clark.
2. Aboral view.
3. Side view.

Fig. 4–6. *Linthia obesa* Arnold and Clark.
4. Aboral view.
5. Rear-end view.
6. Side view.

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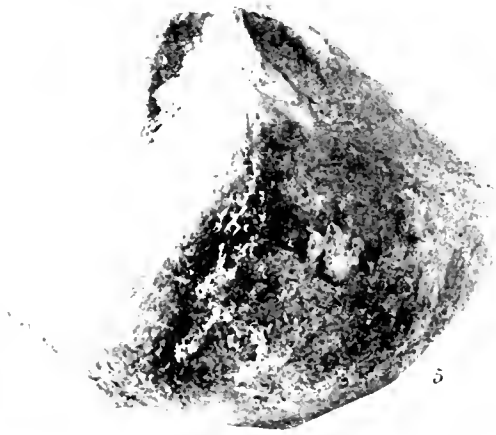

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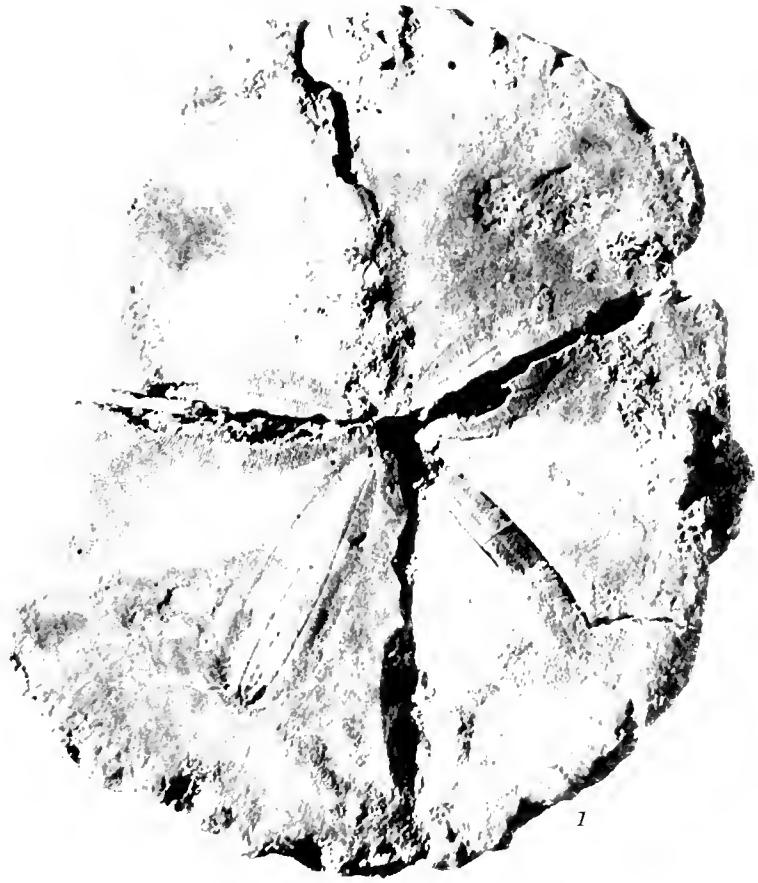

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THE HELIOTYPE CORP. BOSTON

PLATE 3

PLATE 3

Fig. 1–3. *Victoriaster jamaicensis* Arnold and Clark.
1. Aboral view.
2. Oral view.
3. Side view.

Fig. 4, 5. *Cyclaster sterea* Arnold and Clark.
4. Aboral view.
5. Side view.

5

4

3

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2

THE HELIOTYPE CORP., BOSTON

PLATE 4

PLATE 4

Fig. 1, 2. *Macropneustes dyscritus* Arnold and Clark.
1. Aboral view.
2. Side view.

Fig. 3. *Macropneustes sinuosus* Arnold and Clark.
Aboral view.

Fig. 4, 5. *Macropneustes stenopetalus* Arnold and Clark.
4. Aboral view.
5. Side view.

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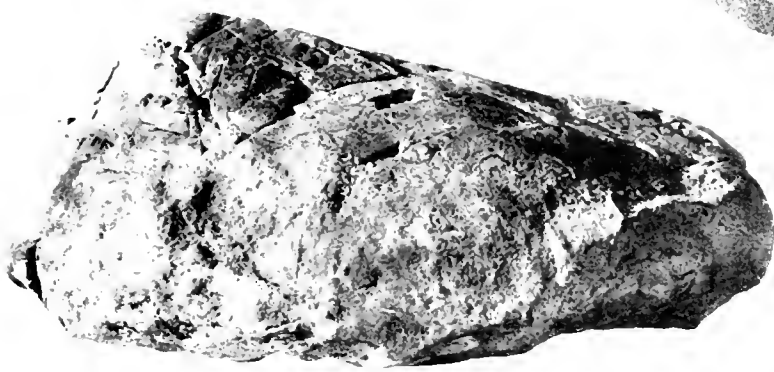

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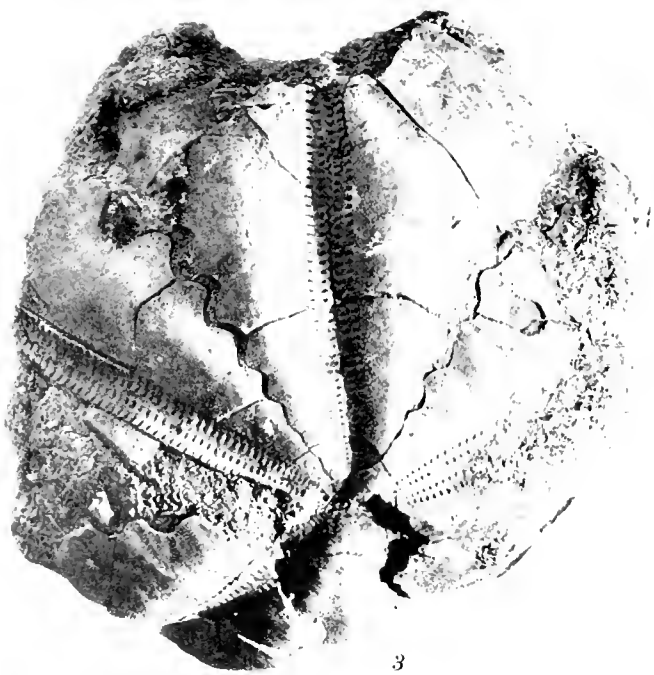

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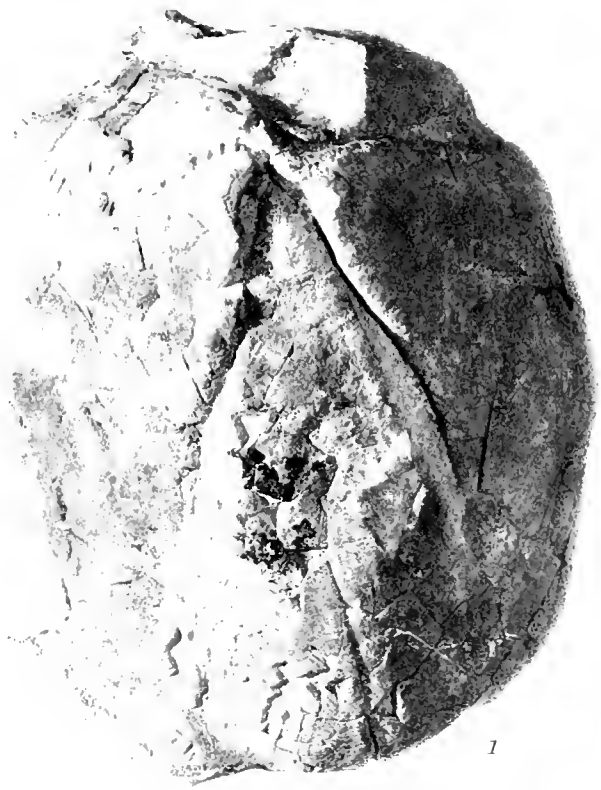

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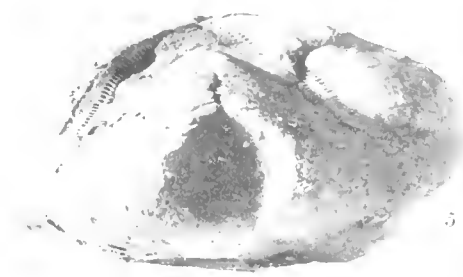
THE HELIOTYPE CORP. BOSTON

PLATE 5

PLATE 5

Fig. 1–3. *Metalia jamaicensis* Arnold and Clark.
1. Aboral view.
2. Oral view.
3. Side view.

Fig. 4–6. *Metalia dubia* Arnold and Clark.
4. Aboral view.
5. Rear-end view.
6. Side view.



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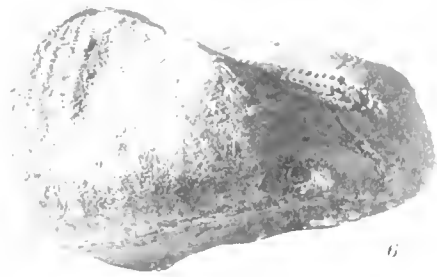

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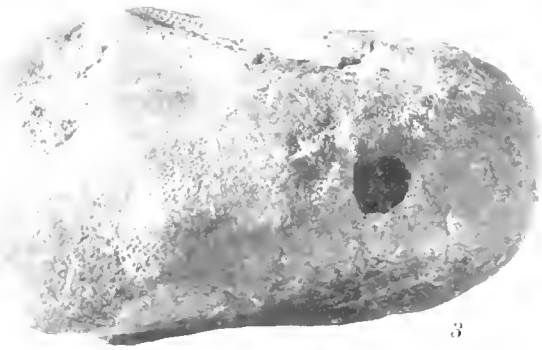

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